

# PHYS 210: ADVANCED CLASSICAL MECHANICS

---

## In Workflow

1. PHYS Committee Chair (mikkel.jensen@csus.edu)
2. PHYS Chair (degraff@csus.edu)
3. NSM College Committee Chair (mikkel.jensen@csus.edu)
4. NSM Dean (datwyler@csus.edu)
5. Academic Services (catalog@csus.edu)
6. Senate Curriculum Subcommittee Chair (curriculum@csus.edu)
7. Dean of Undergraduate (gardner@csus.edu)
8. Dean of Graduate (cnewsome@skymail.csus.edu)
9. Catalog Editor (catalog@csus.edu)
10. Registrar's Office (k.mcfarland@csus.edu)
11. PeopleSoft (PeopleSoft@csus.edu)

## Approval Path

1. Fri, 13 Sep 2024 19:57:34 GMT  
Mikkel Jensen (mikkel.jensen): Approved for PHYS Committee Chair
2. Fri, 13 Sep 2024 19:59:24 GMT  
William DeGraffenreid (degraff): Approved for PHYS Chair
3. Wed, 02 Oct 2024 22:38:52 GMT  
Mikkel Jensen (mikkel.jensen): Approved for NSM College Committee Chair
4. Fri, 11 Oct 2024 18:35:34 GMT  
Chris Taylor (ctaylor): Approved for NSM Dean

## New Course Proposal

Date Submitted: Wed, 11 Sep 2024 16:24:00 GMT

**Viewing: PHYS 210 : Advanced Classical Mechanics**

**Last edit: Wed, 02 Oct 2024 22:38:27 GMT**

Changes proposed by: Rodolfo Barniol Duran (219696192)

**Contact(s):**

Name (First Last)	Email	Phone 999-999-9999
Alexander Pettitt	pettitt@csus.edu	916-278-6362
Rodolfo Barniol Duran	barniolduran@csus.edu	916-278-5827
Michael Ray	ray@csus.edu	916-278-6501
Christopher Hodges	christopher.hodges@csus.edu	916-278-6518
Christopher Taylor	ctaylor@csus.edu	916-278-6518

**Catalog Title:**

Advanced Classical Mechanics

**Class Schedule Title:**

Advanced Classical Mechanics

**Academic Group: (College)**

NSM - Natural Sciences & Mathematics

**Academic Organization: (Department)**

Physics and Astronomy

**Will this course be offered through the College of Continuing Education (CCE)?**

No

**Catalog Year Effective:**

Fall 2025 (2025/2026 Catalog)

**Subject Area: (prefix)**

PHYS - Physics

**Catalog Number: (course number)**

210

**Course ID: (For administrative use only.)**

TBD

**Units:**

3

**Is the ONLY purpose of this change to update the term typically offered or the enforcement of existing requisites at registration?**

No

**In what term(s) will this course typically be offered?**

Fall term only

**Does this course require a room for its final exam?**

Yes, final exam requires a room

**Does this course replace an existing experimental course?**

No

**This course complies with the credit hour policy:**

Yes

**Justification for course proposal:**

Classical mechanics is a fundamental pillar of physics and as such this course acts as a "core" requirement of the MS Physics program. The purpose of this course is to first review the upper-division mechanics seen in undergraduate physics courses and then move on to advanced topics that appear in modern physics research. This pertains not only to classical topics such as gravitation and solid state physics, but also to more modern topics, such as particle physics and quantum mechanics in the form of scattering phenomena and Hamiltonian action integrals.

**Course Description: (Not to exceed 90 words and language should conform to catalog copy.)**

Introduction to graduate level classical mechanics. Review of Newton's laws of motion; D'Alambert Principle and Lagrangian dynamics; central forces; kinematics and dynamics of rigid-body motion; small oscillations; Hamilton's equations; canonical transformations; Hamilton-Jacobi theory and action-angle variables.

**Are one or more field trips required with this course?**

No

**Fee Course?**

No

**Is this course designated as Service Learning?**

No

**Is this course designated as Curricular Community Engaged Learning?**

No

**Does this course require safety training?**

No

**Does this course require personal protective equipment (PPE)?**

No

**Does this course have prerequisites?**

Yes

**Prerequisite:**

PHYS 156, or instructor permission.

**Prerequisites Enforced at Registration?**

Yes

**Does this course have corequisites?**

No

**Graded:**

Letter

**Approval required for enrollment?**

No Approval Required

**Course Component(s) and Classification(s):**

Lecture

**Lecture Classification**

CS#02 - Lecture/Discussion (K-factor=1 WTU per unit)

**Lecture Units**

3

**Is this a paired course?**

No

**Is this course crosslisted?**

No

**Can this course be repeated for credit?**

No

**Can the course be taken for credit more than once during the same term?**

No

**Description of the Expected Learning Outcomes and Assessment Strategies:**

List the Expected Learning Outcomes and their accompanying Assessment Strategies (e.g., portfolios, examinations, performances, pre-and post-tests, conferences with students, student papers). Click the plus sign to add a new row.

	Expected Learning Outcome	Assessment Strategies
1	Formulate solutions to advanced classical mechanics problems through analytical techniques (such as Lagrangian multipliers, tensor arithmetic and minimizing actions)	Quizzes, graded homework, midterm and final exams
2	Solve complex physical systems using a variety of different formalisms (Lagrangian, Hamiltonian, Hamilton-Jacobi) and critically evaluate its suitability for a given problem	Quizzes, graded homework, midterm and final exams
3	Apply variational principles to determine the evolution and stability of simple mechanical/mathematical systems	Quizzes, graded homework, midterm and final exams
4	Model multi-dimensional mechanical systems in abstract coordinate systems and canonically-conjugate variables to garner a clear picture of their physical evolution	Quizzes, graded homework, midterm and final exams
5	Explain how symmetries in physical systems relate to conservation properties/invariances and how these bridge classical-quantum mechanical frameworks	Quizzes, graded homework, midterm and final exams

**Attach a list of the required/recommended course readings and activities:**

PHYS 210 AdvancedClassicalMech.docx

**For whom is this course being developed?**

Majors in the Dept

**Is this course required in a degree program (major, minor, graduate degree, certificate?)**

Yes

**Has a corresponding Program Change been submitted to Workflow?**

No

**Identify the program(s) in which this course is required:**

**Programs:**

MS in Physics

**Does the proposed change or addition cause a significant increase in the use of College or University resources (lab room, computer)?**

No

**Will there be any departments affected by this proposed course?**

No

**I/we as the author(s) of this course proposal agree to provide a new or updated accessibility checklist to the Dean's office prior to the semester when this course is taught utilizing the changes proposed here.**

I/we agree

## **University Learning Goals**

**Graduate (Masters) Learning Goals:**

Disciplinary knowledge  
Critical thinking/analysis

**Is this course required as part of a teaching credential program, a single subject, or multiple subject waiver program (e.g., Liberal Studies, Biology) or other school personnel preparation program (e.g., School of Nursing)?**

No

**Is this a Graduate Writing Intensive (GWI) course?**

No

Key: 14753